Europäisches Patentamt | European Patent Office | Office européen des brevets

Bescheinigung | Certificate | Attestation

Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.

The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

03016007.1

EP/04/7574

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

R C van Dijk

Anmeldung Nr:
Application no.: 03016007.1
Demande no:

Anmeldetag:
Date of filing: 15.07.03
Date de dépôt:

Anmelder/Applicant(s)/Demandeur(s):

Crown Cork & Seal Technologies Corporation
11535 South Central Avenue
Alsip, IL 60803-2599
ETATS-UNIS D'AMERIQUE

Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

A multi-layer liner

In Anspruch genommene Priorität(en) / Priority(ies) claimed /Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen/State/Date/File no./Pays/Date/Numéro de dépôt:

Internationale Patentklassifikation/International Patent Classification/
Classification internationale des brevets:

B32B/

Am Anmeldetag benannte Vertragstaaten/Contracting states designated at date of filing/Etats contractants désignées lors du dépôt:

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL
PT RO SE SI SK TR LI

W0277

A MULTI-LAYER LINER

The present invention relates generally to a liner for use with a container closure, and specifically to a multi-layer liner incorporating a barrier function.

For many uses of closures, in particular the mineral water market, there are strict regulations relating to 'migration' from the packaging into the product. In the context of the present invention, migration is the movement of soluble molecules. In the case of a plastics closure, migration can relate to the ingress of soluble molecules originating either from the outside atmosphere or from the closure itself. For example, oxygen can diffuse inwardly from the outside atmosphere, and soluble compounds from the plastics material itself can also diffuse inwardly. A particular problem results from the degradation products of oxidation reactions, which can be promoted by sunlight. For example, when slip additives are oxidised aldehydes are produced; these are very soluble in water and produce an off-taste.

In the same way that inward migration can be undesirable, so can outward migration. For example, the outward migration of carbon dioxide from a carbonated beverage is undesirable.

With recent developments to the barrier properties of containers, a plastics closure can be the weak link in the barrier properties of the package as a whole. It is therefore desirable to have a closure which prevents migration of soluble molecules.

An effective way of preventing migration through a closure is to use a barrier layer in a liner. The packaging industry considers aluminium to be an excellent

barrier material. Aluminium is approved for use with food and beverages, it is opaque, it gives no flavour nor odour contamination and it is a moisture vapour and gas barrier.

Liners are commonly used in plastics container closures to help seal the container. A flexible layer is deformed as it is squeezed between the closure and the container. Accordingly, consideration must be given to the flexibility of the liner as a whole. Aluminium is a hard material and its inclusion in a liner reduces the flexibility of the liner.

Document US 4,774,134 discloses a multi-layer liner incorporating a layer of aluminium foil. The aluminium foil is approximately 1.5mm thick. A 1.5mm layer of aluminium will provide a good barrier, but will significantly increase the overall stiffness of the liner and significantly adds to the overall thickness of the liner.

In the following text, the terms 'top' and 'bottom' when referring to the liner are used to define the orientation of the liner in use. 'Top' refers to that part of the liner which, in use, is closest to the top plate of a closure; and 'bottom' refers to that part of the liner which, in use, is closest to the open end of the closure i.e. closest to the contents of a container.

According to the present invention there is provided a multi-layer liner for use with a container closure, comprising at least one flexible sealing layer adapted to seal the liner against an associated container, an aluminium barrier layer for preventing soluble molecules

entering the container through the liner, characterised in that the aluminium barrier layer has a thickness of less than 20μm whereby the flexibility of the liner is substantially unaffected by its inclusion.

By using a very thin layer of aluminium, such as a coating applied by evaporation, the sealing function is affected by a small amount but the liner now has excellent barrier properties. In addition, the use of a very thin layer of aluminium helps to minimise the overall thickness of the liner and minimises the amount of aluminium usage.

Because the sealing layer itself might also be a source of soluble compounds, the aluminium layer is preferably positioned below the flexible sealing layer i.e. towards or at the bottom of the liner.

The applicant has found that a thickness of 20μm aluminium and below gives a multi-layer liner with good barrier properties in which the stiffness of the liner as a whole is not substantially increased i.e. the sealing properties of the liner are not compromised.

A lower thickness limit for the aluminium layer is imposed because of potential problems with incomplete coverage when the aluminium layer is too thin, which would reduce its barrier properties.

A range of between 30nm and 100nm has been found to be suitable for use in multi-layer liners because of the extremely small increase in the overall stiffness of the liner, together with excellent barrier properties, when such thin layers are incorporated. A thickness of

approximately 50nm has been found to be particularly suitable.

Usually the sealing layer of the multi-layer liner will be formed from a thermoplastic polyolefin such as polyethylene or ethyl vinyl alcohol. It will be well known to the man skilled in the art about the use of thermoplastic polyolefins as sealing layers in multi-layer liners.

An important consideration of the present invention is prevention of migration from the closure, so that in theory an aluminium layer at any position within the liner would be acceptable. However, the positioning of the aluminium layer within the liner is an important consideration. Preferably the layer is as close to the bottom of the liner, i.e. in use as close to the product, as possible. This is to avoid problems with migration of soluble compounds originating in layers above the aluminium layer.

Positioning the aluminium layer as the lowest layer may not desirable because of the potentially damaging effects of mechanical impact as the closure is applied to a container and/or oxidation by the container headspace and by the product in the container. This is a particularly important consideration for the present invention, in which such thin aluminium layers are used.

The multi-layer liner may therefore further comprise a cover layer which covers the aluminium barrier layer. For example, a thin layer of polyethylene, approximately 20μm thick, may be used. The term 'cover' means a protective layer located between the aluminium layer and

the container product i.e. usually at the very bottom of the liner. The cover layer seals the aluminium layer and protects it from oxidation by the container headspace and the product in the container. The cover layer also protects the aluminium layer against direct mechanical impact when the closure is placed on the container and deformed as the closure is lowered to a sealing position.

A multi-layer barrier liner which as a whole is less than 700μm thick is seen as particularly advantageous due to its sealing and barrier efficiencies related to its overall thickness and material usage. Such a liner may comprise, from top to bottom, a sealing layer of ethyl vinyl alcohol which is approximately 650μm thick, a barrier aluminium layer which is approximately 50nm thick and a cover layer of polyethylene which is approximately 20μm thick. The sealing layer comprises by far the greatest part of the thickness of the layer. Keeping other layers as thin as possible allows the overall thickness to be kept below 700μm thick.

In many cases the individual layers of a multi-layer liner are assembled and fused using adhesive layers. However, the inclusion of adhesive layers reduces the flexibility of the liner.

According to a second aspect of the present invention there is provided a method of forming a multi-barrier layer for use with a container closure, comprising the steps of coating a layer of aluminium of thickness less than 20μm onto a cover layer, and co-

extruding a flexible sealing layer onto the aluminium coated cover layer.

The aluminium can be coated onto the cover layer using any suitable technology, such as by evaporation. The coating step does not involve any adhesive. Thereafter the flexible sealing layer is co-extruded onto the aluminium coated cover layer and this process also does not involve adhesion.

The present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:-

Fig.1 is a section of a multi-layer barrier liner according to a first embodiment of the present invention;

Fig.2 is a section of a multi-layer barrier liner according to an alternative embodiment; and

Fig.3 is a section of a multi-layer barrier liner according to the present invention shown inserted into a container closure.

Referring first to Fig.1 there is shown a multi-layer barrier liner generally indicated (10). From top to bottom, the liner (10) comprises a first layer of polyethylene (20) which in this embodiment is 700µm thick. The polyethylene layer (20) is a sealing layer and is attached to a layer of polyethylene terephthalate (30) by a layer of adhesive (25). The polyethylene terephthalate layer (30) is 12µm thick and is coated on its lower side with a layer of aluminium (40). The layer of polyethylene terephthalate (30) is a good base onto which the aluminium layer (40) can easily be applied during production by, for example, evaporation. The

layer of aluminium (40) is 60nm thick and is attached to a second layer of polyethylene (50) by a layer of adhesive (45). The second polyethylene layer (50) is a cover layer and covers the aluminium layer (40). All of the layers are formed from food-approved materials, which will be well known to those skilled in the art.

The first layer of polyethylene (20) is flexible and is used to seal a closure, for which the liner is intended, to a container such as a mineral water bottle. The layer of aluminium (40) is thin enough so that the overall flexibility of the liner is not substantially affected.

Referring now to Fig.2 there is shown an alternative embodiment. The liner (110) comprises a sealing layer of ethyl vinyl alcohol (120), a barrier layer of aluminium (140) and a cover layer of polyethylene (150). The layer of ethyl vinyl alcohol (120) is 650μm thick, the layer of aluminium (140) is 60nm thick, and the layer of polyethylene (150) is 20μm thick.

The liner (110) is produced in two stages. In the first stage the layer of aluminium (140) is applied directly to the layer of polyethylene (150) by any suitable process such as evaporation. In the second stage the layer of ethyl vinyl alcohol is co-extruded on the aluminium side of the newly formed aluminium/polyethylene layers.

This method avoids the use of adhesives, minimising still further the increase in stiffness of the liner by the inclusion of an aluminium barrier layer (140).

Referring now to Fig.3 there is shown a container closure generally indicated (160). The closure (160) comprises a circular top plate (170) and a cylindrical skirt (180) which depends from the periphery of the top plate (170).

The liner (110) of Fig.2 is shown inserted into the closure (160) with the sealing layer (120) attached to the underside of the top plate (170). The sealing layer (120) is at the "top" of the liner (110) and the cover layer (150) is at the "bottom" of the liner.

CLAIMS:

1. A multi-layer liner (10) for use with a container closure, comprising:

- at least one flexible sealing layer (20) adapted to seal the liner against an associated container,
- an aluminium barrier layer (40) for preventing soluble molecules entering the container through the liner,

characterised in that

the aluminium barrier layer (40) has a thickness of less than 20μm whereby the flexibility of the liner is substantially unaffected by its inclusion.

2. A liner (10) according to claim 1, wherein the aluminium barrier layer (40) is positioned below the flexible sealing layer (20).

3. A liner (10) according to Claim 1 or Claim 2, wherein the aluminium barrier layer (40) has a thickness in the range of 30nm to 100nm.

4. A liner (10) according to any of claims 1 to 3 wherein the aluminium barrier layer (40) has thickness of approximately 50nm.

5. A liner (10) according to any preceding claim, wherein the sealing layer (20) is formed from a thermoplastic polyolefin.

6. A liner (10) according to any preceding claim, wherein the thickness of the liner is less than 700μm.

7. A liner (10) according to any preceding claim, wherein the liner further comprises a cover layer (50) for covering the aluminium barrier layer (40).

8. A closure (160) incorporating a liner (110) according to any preceding claim.

9. A method of forming a multi-layer liner (110) for a container closure (160), comprising the steps of:

- coating a layer of aluminium (40) of thickness less than 20μm onto a cover layer (50), and
- co-extruding a flexible sealing layer (20) onto the aluminmium/cover layer.

A B S T R A C T

A MULTI-LAYER LINER

A multi-layer liner (110) for use with a container closure (160) is provided. The liner (10) comprises a flexible sealing layer (20) adapted to seal the closure against an associated container, and an aluminium barrier layer (40) for preventing soluble molecules entering the container through the liner. The aluminium barrier layer (40) has a thickness of less than 20μm, whereby the flexibility of the liner is substantially unaffected by its inclusion. A method of forming a multi-layer liner (110) is also provided.

Fig.3

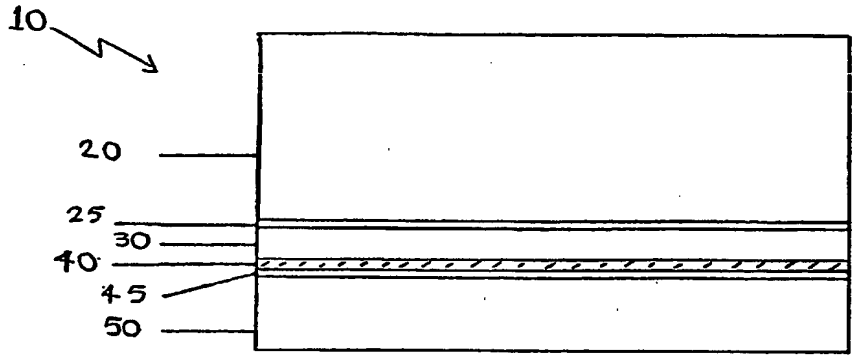

FIG 1

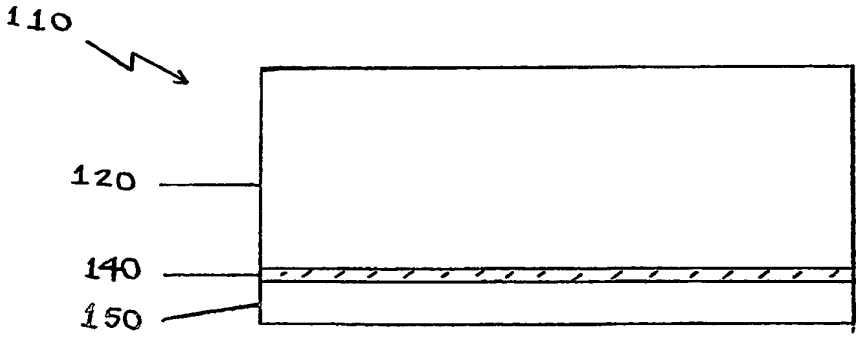

FIG 2

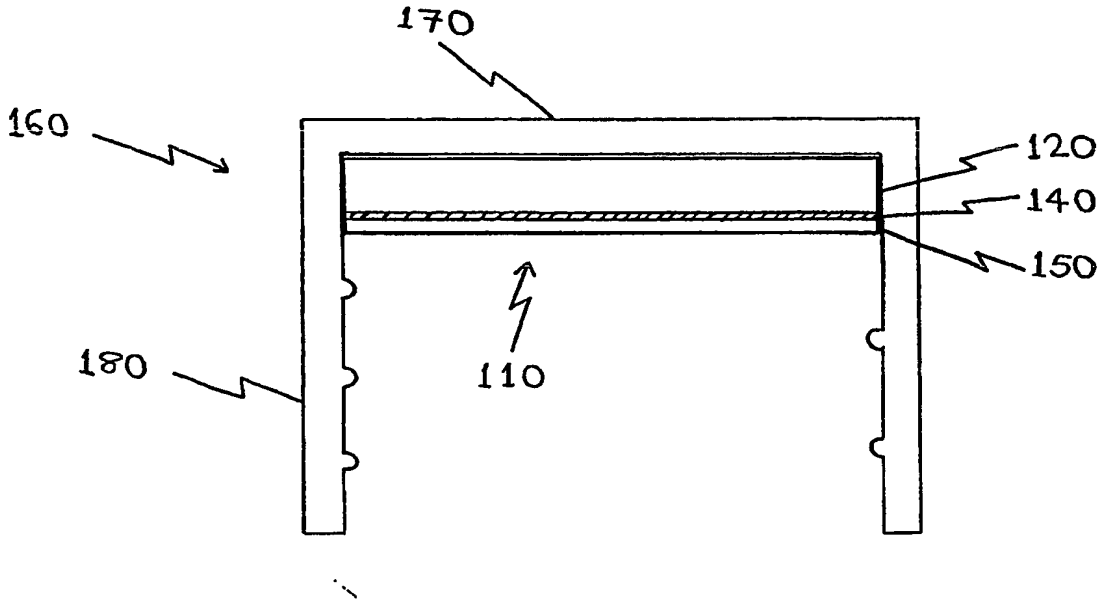

FIG 3